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NOTES ON THE NESTING HABITS OF SOME DIGGER WASPS

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Texas Technological College, Lubbock

Poecilopompilus interruptus interruptus (Say).

This is an interesting wasp because of its close resemblance to the common yellow jacket, *Polistes exclamans,* a wasp of another family and completely different habits. This mimicry is not confined to superficial appearances, which is striking, but manifests itself also in the manner in which the wasp carries itself. Unlike all other Pompilidae, this wasp does not flick its wings while walking but holds them motionless at an angle, reminding one of an alert *Polistes*. When disturbed, it raises the wings slightly and makes a bluff of advancing on its disturber, exactly as a *Polistes* does. And when walking on the ground it never exhibits the "nervousness" of other Pompilidae but its movements are unhurried and deliberate.

Otherwise, judging from the observations recorded below, the nesting habits are not much different from those of the other large Pompilidae.

On September 7, 1949 I saw this wasp dragging a large wolf spider (Lycosidae) across a bare area in my back yard in Lubbock, Texas. It grasped the spider on the venter, between the legs and walked backwards with the heavy spider. In this manner and without stopping, it dragged the spider in a straight line for 27 feet, when it entered a grassy section. How far it had already come I had no way of knowing. After entering the grass it laid the spider down and then spent several minutes reconnoitering. Coming back to the spider, which it found with little difficulty, it started off through the grass at right angles to its first path. Some 12 feet later, after frequent rests and orientation trips it arrived, without too much difficulty, at is nest. This was merely a slight hole in the ground, not nearly big enough to hold the spider. The wasp deposited her spider nearby and then spent several minutes digging the nest to the proper dimensions. Apparently digging was accomplished by lossening the dirt with the mandibles and then scooping it out with the front legs. She pulled the dirt out just far enough so it wouldn't tumble back and then "popped" in again for another load.

When the nest was completed the wasp walked to the spider, dragged it to the entrance and backed in without laying it down. The hole was so shallow that the wasp could easily be seen forcing herself out past the spider. She paused briefly only once and during that pause she apparently laid the egg on the spider. After this brief pause she crawled out, cleaned her antennae and legs and then started filling the hole. This she did by making a scoop of the fore tarsi and pulling the dirt in. After a little dirt had been pulled in she tamped it down with the tip of the abdomen with a trip-hammer action of the entire body. This was a rapid up and down vibration and very interesting to watch. By actual timing each few loads of dirt were tamped in this manner for two to three minutes. As the hole became more nearly full more

and more of the wasp had to remain outside, naturally, so that toward the end the soil was tamped by an up and down vibration of the abdomen only, but still only the tip of the abdomen made contact.

Four days later I dug up the spider. It was apparently in excellent condition though no movements could be elicited. The egg was attached on the left anterodorsal side of the abdomen. It failed to hatch. After some weeks the spider finally shriveled up.

The nest was a shallow hole, about one inch deep and just big enough to accomodate the spider.

Tachypompilus ferrugineus burrus (Cresson)
(Fig. 1)

For years I had been curious about where and how this energetic red spider-killer cached its kill. I have at various times followed them for long distances, watching them patiently while they struggled through a tangle of weeds and grass, floundering in loose sand, going over or around obstacles, always going backward but always seeming to know the right direction. I have sat patiently while they left their spider and spent long minutes reconnoitering, and then come back and spent more long minutes trying to find their spider again. All in all. I have followed a dozen or more of the wasps for varying distances, only to have them crawl under low built houses and out of sight. Once just before sundown, I spotted one approaching a car shed which had nothing but a few odd boxes stored in the back, and I thought surely here I could follow one to the end. It approached the open door of the shed and as luck would have it, the door was resting on the ground and the wasp could not get under. After a lengthy orientation trip she grasped the spider and pulled it straight up the door. There she laid it down and spent more time looking around, finally coming back and lowering the spider on the opposite side and then heading straight for the rear of the shed. But by then it had gotten so dark I could no longer follow her.

About all I had learned so far about their habits was that they prefer wolf spider (Lycosidae) and apparently store them under buildings. I had about despaired of ever seeing one put the prey away when one summer day at the home of Mrs. E. L. Chance, Liberty Hill, Texas, just about 10 minutes before sundown, I saw one approaching the house at a spot where I could crawl under and follow it. Also now I had a couple of errand runners and catching one of them in a cooperative mood I was able to get a flashlight without having to leave the wasp and possibly losing her. Everything worked out beautifully. The wasp entered through a chink in the apron around the house and boys and I wiggled through a nearby trap door. We spotted the wasp without much difficulty and very fortunately she did not seem the least bit disturbed by our presence or by the light of our lamp. The beam was weak and diffused and even when played directly on the wasp she remained completely indifferent to it.

She dragged the spider about six feet in from the entrance and then let it lay. She then walked to a cup-like depression about a foot away and spent some five or ten minutes dressing this chamber, which was in loose, very dry soil. She scratched lightly but very rapidly from the center to all sides, stopping often to tamp the surface smooth with the tip of the abdomen. This

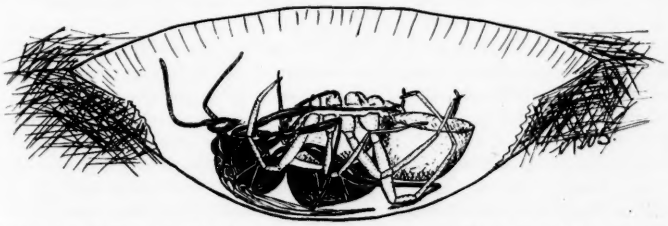
was a very interesting maneuver and was done by beating the soil with the tip of the abdomen, covering the whole area by swinging the abdomen from side to side and by walking forward and backward. The scratching that was done was apparently primarily for smoothing the nest since not enough dirt was removed to appreciably alter either the depth or circumference of the depression. When finished it measured about seven centimeters across and about three centimeters deep.

After she had the nest to her satisfaction she walked back to the spider and after some hesitation and idle walking around she grasped it by the palp and dragged it to and across the hole, letting the spider rest ventral side down on the opposite side of the depression, the tip of the abdomen just in the center of the hole. Here the wasp spent some more time dressing the hole. In a short time however, she straddled the spider and pulled it up and back so that the wasp ended by lying on her back with the spider resting on top of her. Her abdomen curled across the juncture of the cephalthorax and abdomen of the spider and, of course, on the opposite side from us so that we could not see the egg being laid. For a few seconds the abdomen seemed to be probing for the right spot and then for perhaps the space of two seconds it was still and immediately after this the wasp pulled herself free and commenced covering the spider. While lying on her back with the spider on her, the wasp waved her antennae about very rapidly, seemingly in a circular motion.

Covering the spider was done by scratching dirt on it from the periphery of the hole. Dirt was scratched in from all sides and then tamped down with rapid up and down beatings of the slightly bent abdomen. This beating produced a distinctly audible sound. It seemed to us that it took about 15 to 20 minutes before the spider was covered to the wasp's satisfaction but I had no watch and actually it may have been much less time than that. When finished the wasp had dragged up small sticks and pebbles and scattered them over the erstwhile depression.

Here we left it and crawled out from under the house in answer to repeated and ever more insistent demands to come to supper.

Ten days later, about 10 A.M. on July 13, I saw another of these wasps dragging a spider and approaching the house at the other side. I dashed into the house for a flashlight, dashed back and hastily ripped off enough of the apron to allow myself to crawl under the house. I had considerable difficulty



Explanation of Figure 1. *Tachypompilus ferrugineus burrus*. Shows the position the wasp assumes to lay an egg.

spotting the wasp again but finally saw it almost under my nose. It had brought the spider about six feet in from where it had entered and then laid it down to prepare a hole for it. It made several false starts before finally choosing a suitable spot. The procedure otherwise was similar to that of the previous wasp. The hole was tamped smooth with the tip of the abdomen and the spider was dragged across the hole. This wasp however had more difficulty turning it over properly. Three times she turned it over and three times she pulled it back to its original position. On the fourth try she had it to her liking and this time she attached the egg, in exactly the same manner as the first wasp.

These wasps are noiseless workers, the loud humming noise produced by the sphecoid wasps at work is not heard here. The only audible sound, as already mentioned is the dull tapping made when the tip of the abdomen strikes the soil. They go efficiently but not hastily about their work.

Judging from the activities of these wasps around buildings it seems that the general area where the spider will be stored is chosen before a capture is made. However it appears from the above two observations that they do not necessarily prepare a nest before starting their search for a spider.

In 1908 Phil and Nellie Rau (Wasp Studies Afield, pp. 78-83, 1918) found a closely related form of the above wasp to nest in the chinks of old masonry. Apparently no one has observed any nesting activities except at man-made structures. Has this species, and its related forms, adapted itself to nesting only in and under man made structures or does it nest also under natural shelters? More observations on this wasp are certainly in order. Why does the wasp turn the spider on itself? Is it because she needs pressure on the abdomen to be able to lay an egg? Certainly those Pompilidae that store their spider in cylindrical holes always have the diameter so small that they obtain considerable pressure as they force their way out.

The two spiders that were taken from the wasps were *Lycosa rabida* (Walck.) and *Lycosa antelucana* Mont. I wish to thank Dr. K. v. Krombein and Mr. H. H. Swift of the U. S. National Museum for determining the wasps and the spiders respectively.

Bembix hinei Parker

The Texas Gluf coast is the type locality for this interesting Bemicid and the wasps are not rare there, but neither are they particularly abundant. They can be taken now and then on the local beach flora and where the sand is dry and bare. Apparently they frequent only the beach front and are not found farther inland.

It seemed logical to believe they would nest in the sand near the beach but much searching failed to reveal the evidence to verify this assumption. Then on May 23, 1945 Mr. Joe Winston, then sanitary engineer for the University of Texas Medical Branch, invited me to accompany him on a water sampling trip from Galveston to Port Arthur. About 15 miles west of Port Arthur, on a clean-swept and hard-packed strip of beach, just above high tide mark, we found a large nesting colony of these wasps. It covered an area of approximately 50 x 50 feet and contained hundreds of nests. The nests were dense in spots and more widely scattered in other spots. Apparently nesting activities were at their height and all phases were being actively engaged in. Females

were digging holes and bringing in flies (Tabanidae) and the males were actively pursuing the females.

Time was limited and I did not dig up any nests, nor did I have much luck capturing any of the wasps. They are swift fliers. But I marked the spot and made a mental note to revisit it very soon. But time is notorious for not waiting and it was August 5 before I got back again.

I was accompanied this time by Mrs. Strandtmann. We arrived at the nest-area about 9 A.M. after having spent a miserable night on the beach being the *piéce de resistance* at a mosquito banquet. It was a rather cool and cloudy day and no wasps were active at that hour. However, I dug where I thought the nests should be and soon began uncovering them. They were from 6-8 inches deep and at this season contained only pupae and pieces of flies. A good many pupae had already emerged and a good many were dead. Nine live pupae were recovered and four live wasps. Since no wasps were flying we left the area and returned at around I P.M. There were a number of wasps flying now but they seemingly were not engaged in nesting activities.

The prevailing strong on-shore winds have apparently affected the flying powers of these wasps. They are extremely swift fliers and very difficult to net.

The wasps prey on various species of Tabanidae, which are common in the area.

Tachysphex terminatus (Smith)
(Fig. 2)

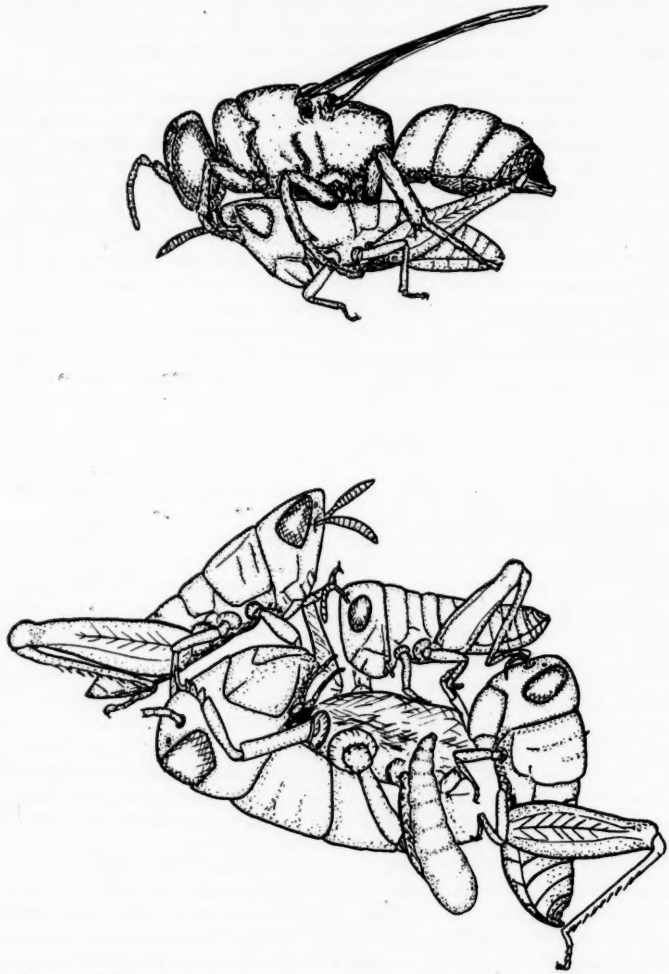
Very little is recorded on the biology of this interesting little wasp so the following notes should be of interest.

A very busy nesting site was found in the summer of 1947 under a farm implement shed on the farm of Otto Strandtmann, near Maxwell, Texas. This is a black land cotton farm recently returned to pasture. The shed opens to the south and the nests were located far enough under the roof to be protected from direct rainfall but not far enough under to be out of direct sunlight.

I first noticed these wasps in July. They had escaped previous attention because by their manner of flying and their size, they had been mistaken for flies. At this season they became active at about 7:30 A.M. There was no great bustle of activity however and only when one trespassed on their meeting sites did they become apparent. The females went purposefully about the business of digging nests and bringing in grasshoppers. The males spent most of their time sunning themselves and making short swift flights after the females, and also chasing one another from resting places.

Nesting occurred in colonies, as in Bembicidae. There were, roughly, three colonies, each covering an area of approximately 20 sq. ft. Individual nests were from seven to ten centimeters long and about three centimetres deep. The tunnel generally sloped evenly at about a 45 degree angle and ended in an enlarged cell. A layer of loose soil about five centimeters deep overlayed a hard subsoil. No nest extended into or beyond this hard subsoil. As far is I could determine there was only one cell per nest.

On August 17 I measured off one square foot of surface in one of the colonies and very carefully excavated the area. Ten cells were uncovered with varying numbers of grasshoppers and immature wasps in various stages of



Explanation of Figure 2. *Tachysphex terminatus*. Upper, manner in which the female transports its prey. Lower, wasp larva surrounded by nymphal grasshoppers.

development. It was difficult to know accurately how many grasshoppers were, or rather, had been in each cell as the larger wasp larvae had obviously already consumed some of the grasshoppers. Two cells contained seven small hoppers each. The number of hoppers per cell was inversely proportional to their size.

On the basis of these nests I dare say that an average of four per nest would be a conservative estimate. If the nests were uniformly distributed over the entire area then there would have been around 600 nests for a total of 2400 grasshoppers. If we assume five generations then this colony of wasps is helping the farmer to the extent of 12,000 grasshoppers per season,—and getting them before the grasshopper has really had a chance to eat.

Although several larvae were found only two were reared to maturity. Larva #1 was certainly no more than two days old when found on August 17. It began its cocoon August 20 and on August 21 the cocoon was complete and dark brown but still moist. On August 28 an adult male emerged. If the larva was two days old when found, and we allow another day for the egg, we still have a complete development in only two weeks.

Larva #2, also found August 17 completed its cocoon August 19 and on August 26 a male emerged. This therefore also required less than two weeks to complete its development. The development of the female very likely takes longer but probably not more than a week longer. It seems to me quite possible that there could be a new generation of females every month.

The period of activity could easily extend over nearly half the year, from May to October inclusive. Of course the number of nests is not static. There should be a period of peak activity and perhaps mid-August is that time. If this is true then of course an estimate of 12,000 grasshoppers per season would be too high.

The grasshoppers recovered were first and second instar nymphs of the short-horned varieties belonging to the genera *Melanoplus* and *Tryxalus*. Dr. A. B. Gurney of the U. S. National Museum kindly determined the grasshoppers and Dr. Krombein determined the wasps.

F. X. Williams (Kans. U. Sci. Bull., 8, 201, 1913) found the wasp with a young tryalid grasshopper. Rau and Rau (Wasp Studies Afield, 144-149, 1918) found the wasps nesting in loose sand and provisioning with nymphs of *Syrbula admirabilis* Uhl., *Dicromorpha viridis* Scud., and *Melanoplus* sp., as well as undetermined species of Oedipodidae and Acrididae. They found that the cells usually contained from 5-9 grasshopper nymphs.

Chlorion habenum Say

As far as I know, nothing at all is known of the biology of this large, handsome, black and gold digger wasp so the following brief note may be of interest.

At about 6:30 on the afternoon of September 12, 1944 I saw one flying just at the top of the tall grass in my back yard at Galveston, Texas. It was carrying with ease a rather large green, nymphal longhorned grasshopper. It settled on the grass and crawled down straight to its nest. I parted the grass and saw a long, low dike of diggings, with the hole at one end of it. About half an hour later the wasp was working at the entrance, putting bits of grass and small lumps of dirt into it, scratching in loose dirt and then tamping it

tight with its mandibles. A couple of days later I saw the wasp again, digging at the entrance but unfortunately I could not stay and watch. On September 26 I could find no sign of activity at the site and I dug up the nest. At a depth of 16 inches I found a cocoon. In appearance it was typical of other *Chlorion* species. I kept it in sand in a salve box, occasionally moistening the sand but it failed to hatch. After slightly more than a year I opened it and found within a fresh but much emaciated larva. It showed no signs of life.

SUMMARY

Pompilidae. *Poecilopompilus interruptus* (Say) not only looks like a *Polistes* but, at least during its nesting activities, acts like one. It holds its wings at a sharp angle to its body like an alert *Polistes* and does not constantly flick them as do most other spider wasps. It stores wolf spiders in short vertical shafts and tamps the soil down with the tip of its abdomen. *Tachypompilus ferrugineus burrus* (Cresson) apparently nests only under buildings, where the soil is loose and very dry. It preys on wolf spiders and stores them in shallow pits. Just prior to egg laying the wasp straddles the spider, which is ventral side down, and pulls it up and back till the wasp is on its back with with the spider on top of her. In this position she lays the eggs and then leaves the spider on its back. The pit is filled by scratching in loose dirt which is tamped down with the tip of the abdomen.

Sphecidae. A large nesting colony of *Bembix hinei* Parker was found on the Texas coast near Port Arthur. The nests were near enough to the water to be in firm sand but far enough back to the be above the normal water table. The colony numbered hundreds of nests. The wasps preyed on various species of horse flies (Tabanidae). A colony of *Tachysphex terminatus* (Smith) numbering several hundred nests has been active for several years under a farm implement shed in south Texas. We believe this is the first record of the wasp nesting in colonies. *Chlorion habenum* (Say) was seen carrying a nymphal grasshopper (Tettigoniidae). Its nest was in sandy, grass-grown soil, and about fifteen inches deep.

COLLEMBOLA FROM ARCTIC AND BOREAL CANADA

HARLOW B. MILLS AND W. R. RICHARDS
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During the summer of 1949 Mr. Paul Queneau, Mr. Peter Scott, and Mr. Harold C. Hanson organized an expedition to northern Canada under the auspices of the Arctic Institute and with funds provided by the United States Office of Naval Research. While Mr. Hanson, the zoologist for the group, spent the major part of his time investigating the vertebrate fauna of the Perry River area, he was able to make some collections of the soil fauna, and there follows a list of the Collembola obtained by him.

The points where collections were made are as follows:

Base camp approximately 17 miles above the mouth of the Perry River in the McKenzie River District, Lat. 67°34′N, Long. 102°07′W.

Flagstaff Island, approximately three miles from the mouth of the Perry River and in Queen Maude Gulf, Lat. 67°45′N, Long. 101°43′W.

Cambridge Bay, approximate position Lat. 69°10′N, Long. 105°W.

Baker Lake in the Keewatin District, approximate position 64°20′N, Long. 96°W.

Churchill, Manitoba, approximate position Lat. 58°50′N, Long. 94°W.

Moose Factory, James Bay, Ontario, approximate position Lat. 51°15′, Long. 80°40′.

Small samples of the ground litter were collected and the specimens were removed later through the use of a Berlese funnel. In all, 16 forms are reported and one species in the genus *Uzelia* is described as new.

Family PODURIDAE Lubbock
Subfamily Achorutinae Börner 1901b
Genus *Achorutes* Templeton
Achorutes tullbergi Schäffer

Localities: Victoria Island, Cambridge Bay, 36 specimens from ground litter July 31; 1 specimen from grassy sod inside ancient Eskimo food cache. July 30, base camp, Perry River.
1 specimen from island in Lake Arlone, upper Perry River, July 21.

A. Tullbergi appears to be a circumpolar arctic species, reported from such localities as Franz Josef Land, Spitzbergen, Ellesmere Land, Demarcation Point, Alaska, and Bernard Harbor, N.W.T. It has been collected in Europe as far south as Bohemia and in North America as far south as Massachusetts.

Achorutes armatus Nicolet

Locality: Victoria Island, Cambridge Bay, 1 specimen from ground litter, July 31.

This is one of the most cosmopolitan species of Collembola, being distributed through most of the world in suitable habitats.

Subfamily Neanurinae Börner
Genus *Friesea* Dalla Torre
Friesea sp.

Locality: Victoria Island, Cambridge Bay, 1 specimen from ground litter, July 31.

The one specimen in this species which was available for study falls in the group of species composed of *quinquespinosa* Wahlgren, *bodenheimeri* Börner, and *pentacantha* Mills. Structurally it appears to combine characters of, and show the greatest affinities to, *quinquespinosa* and *pentacantha*. Until more material is available it is best to list this species without identification or description.

Subfamily Onychurinae Börner
Genus *Onychiurus* Gervais
Onychiurus pseudarmatus Folsom

Locality: Perry River, 4 specimens from a "heather" clump, July 30.

While this species and the following are closely allied, the differences noted by Folsom (1917) are of such a nature that it seems best to keep the species separate until a large series of both forms are available for comparison.

The 4 specimens here considered to be *pseudarmatus* differ slightly from the typical form. There are 3 pseudocelli on Abd. IV instead of 2, but such variations are commonly seen in this genus. The species was recorded previously from St. Paul Island, Alaska, and Hurry Fjord, East Greenland.

Onychiurus armatus Tullberg

Locality: Victoria Island, Cambridge Bay. 2 specimens from ground litter, July 31.

O. armatus is a Holarctic species and not limited to boreal regions. It appears to be common in Europe and fairly abundant in North America.

Onychiurus duodecimpunctatus Folsom

Locality: Victoria Island, Cambridge Bay. 1 specimen from ground litter, July 31.

This appears to be an arctic species, being described from Bernard Harbour, N.W.T., and known only from the American arctic.

Family ENTOMOBRYIDAE Tömösvary
Subfamily Isotominae Schäffer
Genus *Folsomia* Willem
Folsomia quadrioculata (Tullberg)

Localities: Baker Lake, N.W.T., 6 specimens from upland tundra litter, August 3. Perry River, 1 specimen from grassy sod inside an ancient Eskimo food cache, July 30.

A widely distributed Holarctic species.

Folsomia diplophthalma (Axelson)

Locality: Lake MacAlpine, Perry River Area, Several specimens from lichen tundra slope, July 25.

This species is characteristically northern-Holarctic in distribution. It has been taken as far south as Illinois in North America, and has been reported from New Zealand.

Folsomia fimetaria (L.)

Locality: Moose Factory, James Bay, 1 specimen, August 5.

This species is cosmopolitan in its distribution and rather variable. The specimen examined was referable to the principal form.

Genus *Uzelia* Absolon
Uzelia hansoni n. sp.

Dark blue, often with a purplish tinge. Pigment incomplete anteriorly on body segments. Often with pale lateral spots on each segment, circular pale spots dorsoposteriorly on the head, and in two more or less parallel vertical lines below the eyes. Venter and legs pale, furcula pigmented except at apex. Prothorax pale with dorsal and lateral pigmented areas. Younger specimens paler with less complete pigmentation.

Body subcylindrical, elongate, narrowed posteriorly; Tetracanthelloid in appearance.

Eyes 8 on either side, in two groups separated by one long seta subequal to Ant. IV in length. The anterior group consists of 5 eyes, the posterior group of 3. Eyes G and H reduced in size. Postantennal organ narrowly elliptical, in length subequal to twice the diameter of one of the larger eyes, Fig. 2. Antennae shorter than the head diagonal; ratio of segments I to IV in fully grown specimens about as 1:2:2:3. Sense organ of Ant. III consists of 2 slender, free clubs. Guard setae unmodified, 1 on either side and 1 below. Dorso-laterad of sense clubs is a minute setula, another occurring behind the rods and at the base of the segment, Fig. 1. Antennae clothed with slender curved setae, the longest of which are ⅔ the width of the segment upon which they occur. Apex of Ant. IV bears 2 slender, straight, somewhat truncated, relatively short setae.

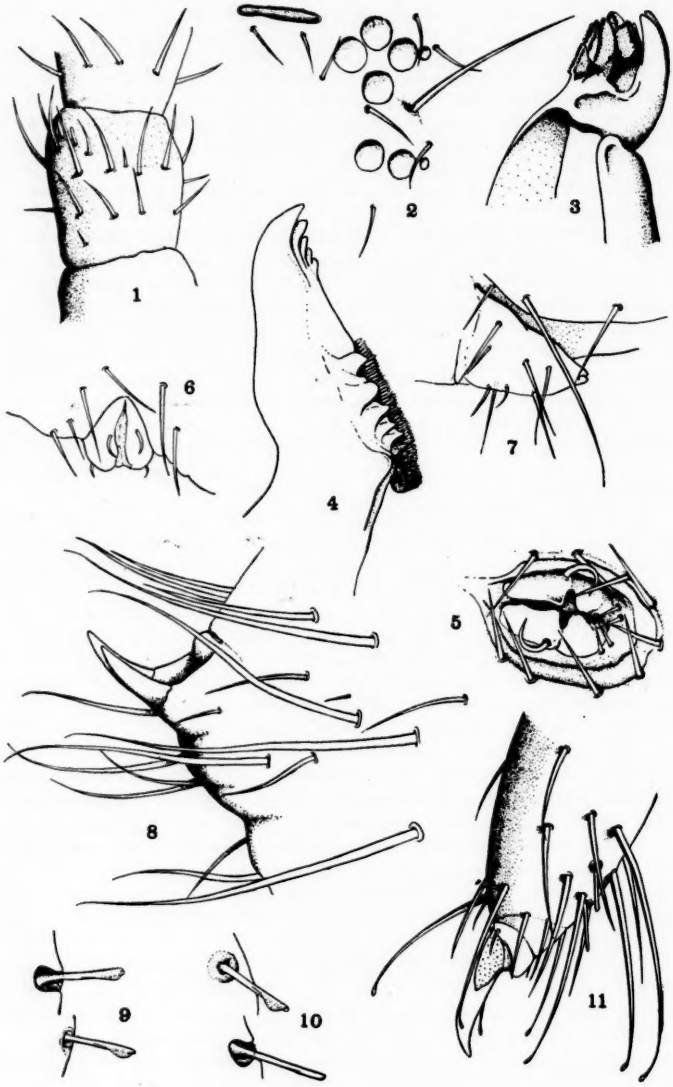
Mandibles with 5 incising teeth apically. Molar region with 5 or 6 large triangular teeth and an expanded field of fine, sharp spicules, Fig. 4. Maxilla head with 3 teeth and 6 more or less semicircular lamellae on the inner face. Edges of these lamellae minutely serrate or pectinate, Fig. 3.

Prothorax membranous, without setae. Thorax II to III in adult specimens as 1:1. Legs normal in shape. A long, tendriliform seta on inner proximal surface of II and III femora, tips of the setae reaching to the ventral tibiotarsal hairs, in some cases almost to the claw bases. Femora I bear similar setae which reach only to near the apex of the segment.

Abd. V and VI completely ankylosed. Segments I, II, III, IV, V and VI, in adult specimens as 1 : 1.1 : 1.1 : 1.3 : 0.7, IV always longest and V and VI always shortest. Tergites II to IV produced laterally as to slightly envelop the abdomen. Anal horns 2, on conical, contiguous papillae: ⅔ the length of hind unguis. A fine, minute setula antero-basally on each papilla, Fig. 8.

A short curved seta present on each end of the anterior and posterior lips of the female genital orifice, Fig. 6. Male genital orifice on small papilla situated in a shallow depression behind furcula base. Nine guard setae on anterior and lateral margins of the depression, 4 short setae anteriorly and 1 short curved seta on either side of the papilla, Fig. 5.

Ungues slender, untoothed; unguiculus absent. Prothoracic tibiotarsi with 2 dorsal clavate tenent hairs, 3 on each of the other legs; 4, occasionally 3, similar hairs are attached ventrally to each leg. Thus the tenent hair count is usually 6-7-7. Proximal ventral tenent hairs longest, slightly longer than twice the ventral edge of the unguis. Among the tenent hairs are usually 2 to 4 simple pointed hairs which extend beyond the base of the claw. Ventrally, near the apex of the hind tibiotarsus of the male are 2 truncate setae situated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in deep cup-shaped depressions, Fig. 11. In one specimen (x2100) the apices of three of these structures appeared to bear membranous lamella (possibly split during the clearing process), Figs. 9, 10. Length of these setae slightly less than half the inner edge of the unguis. Immature specimens and females lack these structures.

Furcula present, reduced to a triangular lobe, about half the length of Abd. IV, minutely bifurcate or entire apically. Three dorsal setae distally, ⅔ the length of the furcula and arranged in a triangle. Mesally 1 short curved seta, and basally there are 2 straight ones of unequal length on each side. Usually there is a constriction between the distal group of 3 and the proximal group of 5 setae, Fig. 7.

Tenaculum absent; a flat obscure elevation bearing a seta and lying on the venter of Abd. III may be a tenacular rudiment.

Somewhat sparsely clothed with relatively long simple curved setae, becoming longer posteriorly, especially around the anus. Two macrosetae laterally on either side of each tergite on Th. I, II, and Abd. I. Three on Abd. II and III. Five or 6 on Abd. IV in 2 irregular rows. The most ventral of these setae longest, sometimes ⅔ the length of the tergite on which they occur. Six long pygial setae laterally, between dorsum and dorsal limits of anus, hook-shaped apically before clearing.

Laterad of furcula insertion, on paratergite IV, a single tendriliform seta on either side, one and one-half to more than twice the total length of furcula.

Integument smooth even under high magnification.

Length: males up to 1.4 mm.; females up to 1.7 mm.

Cotypes: Baker Lake, N.W.T., August 3, 8 specimens from upland tundra. Perry River, N.W.T., July 30, 19 specimens (mostly immature) from near mouth of river. All specimens from Berlese funnel collections, H. C. Hanson. In the collection of the Illinois Natural History Survey.

Uzelia hansoni is interesting in that it bears a conspicuous, however small furcula, which structure is absent from all other species in the genus but present in all but one species in the closely related genus *Tetracanthella.* The present species lacks the reticulate integument of *Tetracanthella,* and the sense rods of Ant. III are not subtended by an integumentary fold. There is no evidence of an unguiculus. The two anal horns are not inserted on a single, bifurcate papilla as illustrated by Stach (1947) for *U. setifera.* Further, in his diagnosis of *Uzelia* Stach says, "The sixth abdominal segment with two short anal spines inserted on high anal papillae, which are united together." The anal spines in *U. hansoni* more closely resemble the posterior pair in

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Figure

1. Organ of the third antennal segment
2. Eye patch and post antennal organ
3. Maxilla
4. Mandible
5. Male genital orifice
6. Female genital orifice
7. Furcula
8. Anal horns
9. & 10. Truncate, tibiotarsal organs of the last legs of the male
11. Unguis and apex of tibiotarsus of a male

Tetracanthella. This interesting combination of characters leads to the possibility that *Uzelia* should be considered a subgenus under *Tetracanthella* if the relationships between the two species groups are to be more accurately indicated.

This is the first record of an *Uzelia* in North America; all other known species are Palearctic.

Genus *Anurophorus* Nicolet
Anurophorus laricis Nicolet

Locality: Baker Lake, N.W.T., 17 specimens from upland tundra litter, August 3.

A Holarctic species, moderately common both in Europe and North America where it has been collected as far south as Colorado and Iowa. The above record is the farthest north for the species in the Western Hemisphere. While the species is commonly cortical, there are several records of humus collectins, and *A. laricis* var. *pallida* Absolon is apparently cavernicolous.

Genus *Isotoma* Bourlet
Isotoma sp.

Locality: Island in Lake Arlone, Upper Perry River, 8 specimens from beneath rocks, July 21.

We do not at present assign these speciments to a known species. In general facies they appear to be *I. virdis* Bourlet. They differ, however, in some respects, chief among which are the presence of ciliations on the larger body bristles and the presence of 5 to 7 large spine-like bristles mesoventrally at the apex of the manubrium in some of the specimens. The latter character would appear to ally this series with *I. spinicauda* Bonet from India, but in our specimens there is some variation in the size and number of these modified bristles. The cosmopolitan species *I. virdis* appears in many color forms, and in some structural variation; it and closely related species, of which there are several, are in need of thorough investigation.

Genus *Isotomurus* Böner
Isotomurus palustris var. *prasinus* Reuter

Locality: Churchill, Man., 20 specimens from Berlese sample, August 3.

This variety of the common *I. palustris* Müller is widespread in the Holarctic Region; it has been taken from as far south as Havana, Cuba.

Subfamily Entomobryinae Schäffer
Genus *Entomobyra* Rondani
Entomobyra comparata Folsom

Localities: Perry River, N.W.T., 2 specimens from lichen tundra slope, July 28. Victoria Lsland, Cambridge Bay, 2 specimens from ground litter, July 31. Flagstaff Island, Queen Maud Gulf, 1 specimen, July 30.

The specimens recorded above agree well with Folsom's description of Alaskan material. Other boreal Nearctic species are *E. kinkaidi* Folsom from Alaska and *E. erratica* Brown from the Hudson Straits.

Genus *Lepidocyrtus* Bourlet
Lepidocyrtus cyaneus var. *aenescens* Guthrie

Locality: Churchill, Man., 3 specimens from a ground litter sample, August

This species is widely distributed throughout the Holarctic Region; it is one of the commonest Collembola in temperate areas, occurring beneath bark, under logs and stones, and in humus. It has been reported previously from Demarcation Point, Alaska and from West Greenland in the north of the American continent, but records from the central arctic are lacking.

Subfamily Tomocerinae Schäffer
Genus *Tomocerus* Nicolet
Tomocerus flavescens var. *americanus* Schött

Locality: Perry River, N.W.T., from debris under stones on an island, 3 specimens, July 21.

The usual form of this variable species in the north is *T. f. arcticus* Schött. This more southern variety has been recorded once from Alaska, however.

HOUSE INFESTING ANTS IN SALT LAKE CITY, UTAH

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A recent investigation of ants reported to be infesting homes and business buildings has revealed several species not heretofore important as pests in this region. House ants have not been frequently reported from this area in the past and the senior author, who has collected ant species in this region for the past 15 years, has been acquainted with but few instances where local species constituted a pest. Recently, numerous reports have been received concerning infestation of homes with ants. One of the species collected following these reports was determined to be Pharaoh's ant, *Monomorium pharaonis* (Linn.), a species that apparently has been introduced recently and has become established. Extensive collections previously made in Salt Lake County, Rees and Grundmann (1940) and Cole (1942), and more recent work since 1946, have failed to reveal this species as present until the current season. This species has constituted an important pest in many of the urban areas of the country, and it appears likely that it may do so locally. The ant has probably been introduced along with food materials shipped in from infested areas.

A native species, *Solenopsis molesta* var. *validiuscula* Emery, has been noted as becoming increasingly prevalent as an invader of homes and business buildings in Salt Lake City. This ant is quite common locally, especially along the foothills and lower slopes of the Wasatch and Oquirrh mountains bordering the Salt Lake Valley. It normally nests under stones that are sufficiently large to provide a more or less stable environment as regards temperature and moisture, and being hypogaeic by habit, the ants are usually not seen

unless the overlying stones are removed and their workings uncovered. In nature the species is usually active at night and quiescent during the day unless disturbed or unless abundant food is available. In the house infestations observed this species appears to be active by day as well as by night, and in a number of instances, has been found making trails to kitchen sinks apparently in search of moisture. Nests have been found under baseboards, in basements, and in the foundations of homes, locations which allow the species to be active during cold weather and making for a twelve months control problem.

Another interesting observation is that most infestations have been in the older, well established residential districts of the city and reports have not been particularly abundant from the newer areas of the city that have encroached upon the ant's normal habitat. Modern construction techniques as used in the newer homes probably account for this condition by providing tighter homes with fewer nesting sites. Observations further seem to indicate that this species is adapting itself to living in houses in urban areas as these become established in their normal territories.

The thief ant, *Solenopsis molesta* (Say) has been reported from several Utah localities into which it has no doubt been introduced. This species was not recovered from Salt Lake City during the present study, but does constitute a household pest in its normal range. *S. molesta* may at times be confused with its variety *validiuscula* since the most obvious distinction between the two forms is the infuscation of the latter. This character does not seem constant. Numerous colonies of *validiuscula* have been collected during the summer months that show little coloration and make easy distinction from *molesta* difficult.

Monomorium minimum Buckley, a common species in this region has not been observed as a household pest although its normal habitat is the same as that of *S. molesta* var. *validiuscula*. This species has also been reported frequently as a household pest in other regions, but seems content to nest in fields and vacant lots in the Salt Lake City area. Observations indicate that as the city pushes into the dry benchlands, the continued watering of lawns and gardens plus the elimination of the native plant cover appears to make the habitat unfavorable and the species soon migrates to drier places.

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TWO NEW SPECIES OF SINEA (HEMIPTERA, REDUVIIDAE).

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These two species are described from specimens in the collection of the Museum of Zoology of the University of Michigan. Both of them have only an inconspicuous tubercle in place of a pre-apical spine on the dorsal side of the front femora, agreeing in this respect with *Sinea defecta* as originally described by Stål, but each has numerous characters that set it apart from that species.

Stål (1862, p. 445) characterized *S. defecta* as having tubercles, rather than the spines usually found in the genus, not only on the fore femora above but also on the head and the anterior pronotal lobe. His unique female type was stated to be 14 mm. in length, with the first antennal segment biannulate with pale and with the abdomen as a whole (not the individual segments) rounded-ampliate. In a later publication Stål (1872, p. 71) wrote that he had received a specimen of *defecta* with normal spines on the fore femora; and Champion (1899, p. 295), who presumably had before him Stål's type of this as well as other species, assumed that its dorsal femoral spines had accidently been broken off. Champion applied the name *defecta* to a species with relatively short spines on the head, and while he nowhere indicated the size of his specimens he remarked that *defecta,* as he understood it, was very like *Sinea spinipes* H.S. as identified by Uhler. Champion's identification of *defecta* was accepted by Caudell (1901, p. 11).

Females of *S. spinipes* that I have seen do not exceed 12.5 mm. in length, and numerous females of a form before me that run to *defecta* in the keys of Champion and Caudell are in no case more than 12 mm. long. These latter specimens, collected in Chiapas, Guerrero, Puebla, Michoacán and Panamá, differ from *spinipes* in precisely the ways indicated by Champion for *defecta.* However, the disparity in size as compared with Stål's original description raises some doubt in my mind as to the correctness of Champion's identification of the species. This matter should be investigated further, particularly since the reduction of the femoral dorsal spines to mere tubercles is plainly not a consequence of accident in the new species described below.

It should be noted that in these descriptions all ocular micrometer measurements have been converted into hundredths of a millimeter. As I have stated in an article in press elsewhere, this seems to me to be a far more satisfactory descriptive technique than the usual one of expressing them in arbitrary units of a micrometer scale.

Sinea anacantha, n. sp.

Length, ♂ 12.5-12.8 mm., ♀ 13.3-13.6 mm. Width, across pronotum, ♂ 2.9-3.1 mm., ♀ 3.1-3.3 mm.; across abdomen of female, up to 4.6 mm., depending on the position of the connexivum in the individual specimen.

Color varying from ashy gray to flavo-testaceous or stramineous; neck and head behind the eyes infuscated above, as also usually the anterior lobe

of the pronotum, these parts generally more or less cinereo-pubescent; antennae and legs pale, the tibiae and tarsi lightly embrowned at the tips, the claws piceous; rostrum more or less piceous above; clavus and open marginal cell beyond its apex hyaline, brown; base of the membrane and a streak along its apical vein brown. Meso- and metasternum blackish; venter varying from blackish with a row of large oblique yellowish spots on each side of the disk, to flavous with a large triangular blackish spot (dotted with flavous) near the middle on each side of segments 3 to 6, the 7th segment with an obsolete blackish streak instead of a distinct spot. Connexival segments largely brown above, alternated with flavous, each segment (in the female only) with a moderately large translucent area within the lateral margin, smaller on the basal and the apical segments than on the others.

Head a little longer than the pronotum (♂ 283:250, ♀ 316:288), about two and one-half times as long as wide across the eyes (♂ 283:114, ♀ 316: 125), the interocular space three times as wide as an eye (♀ 75:25). First antennal segment about one-fourth longer than the head (♂ 386:283, ♀ 397:316), about two and one-half times as long as the second segment. Cephalic spines somewhat variable in thickness, the proximal (interocular) pair not longer than the thickness of the first rostral segment, the second pair distinctly shorter, the third (distal) pair much thicker, not or scarcely as long as the first pair, directed somewhat forward and upward. Head and neck sparsely and finely granulated, less plainly so before the eyes.

Pronotum as long as wide, the anterior lobe with short, acute, conical tubercles, the anterior carinae of the hind lobe with a few spinules; posterior lobe with the lateral and postero-lateral margins straight or nearly so, the humeral angles rectangular, very slightly produced outward; posterior margin lightly concave before the scutellum and provided with a few horizontal spinules; postero-lateral margins usually also with a few spinules. Posterior lobe distinctly bigibbous, considerably shorter than the anterior lobe (125:175).

Fore femora with an inconspicuous tubercle instead of a spine on the dorsal side near the apex, and without a supernumerary spine (such as is found in *Sinea complexa* and *S. coronata*) on the inner (anterior) side between this tubercle and the distal spine of the antero-ventral series. Tibial spines distinctly shorter than in other species of *Sinea,* those of the outer or posterior series not longer than the thickness of the tibia, the antero-ventral series with three spines only and without trace of a shorter spine before the first long one (as found in *S. diadema, S. confusa* and others), the proximal and the distal spines of this series about equally distant from their respective ends of the tibia. Meso- and metapleura, also the anterior part of the propleura, sparsely granulate.

Abdominal margins of the female rather strongly undulate (about as in *S. confusa*), those of the male scarcely so. Last abdominal segment of the male with the lateral margins subparallel at the base, then oblique and lightly sinuate to the narrowly truncated apex of the segment, this segment as seen from above about one-half wider at the base than its median length (238:150). Terminal spine of male hypopygium blunt, stout, about as long as thick, almost truncate at the tip; parameres slender at the base, clavate

and pilose at the tip, not visibly curved as seen *in situ*, quite similar to those of other species of *Sinea*.

Holotype, male: Payson Canyon, Utah County, UTAH, *Allotype*, female, Slaterville, Weber County, Utah. *Paratypes*, two males and one female, Farr West, Weber County, Utah (all of the preceding collected by C. J. D. Brown); also one male, Springerville, Apache County, ARIZONA, 7200 ft. elevation, Aug. 19, 1935 (I. J. Cantrall). Slaterville and Farr West are in the Ogden area; the four specimens from these localities are much paler and more yellowish than the other two.

This species is distinguished from the others of the genus by a combination of characters which includes the tubercle instead of a spine on the dorsal side of the front femora, the short tibial spines, the short but acute tubercles on the front lobe of the pronotum, the spinules on the carinae of the hind lobe, and the undulate abdominal margin.

One specimen in the University of Michigan collection from Monte Vista, Rio Grande County, Colorado, Aug. 19, 1925 (F. M. Gaige) likewise has only a small tubercle on the front femora, but otherwise it seems to be quite similar to the unnamed "variety" of *Sinea confusa* (*S. undulata* Champ. nec Uhler) described by Champion. Lacking further material, I prefer to leave it unnamed for the present.

Sinea sericea n. sp.

Length, ♂ 10.8 mm., width of pronotum 2.75 mm.

Black, the posterior lobe of the pronotum dark reddish-piceous; first antennal segment (except towards the base), veins of the corium, apex of scutellum, a spot occupying the posterior half or more of each connexival segment above, and venter (except a large mottled blackish area at each side of the middle on each segment) flavous or flavotestaceous. Front femora brown, densely pale-granulated, front tibiae piceous with narrow basal and broad pre-apical pale bands, the spines pale with piceous tips; middle and hind legs pale, the femora with more or less distinct basal and pre-apical dark bands, the tibiae with the apical portion and a sub-basal band brown; rostrum pale, the upper side of the first two segments and the apical half of the third piceous. Head and neck (including the gula), and anterior lobe of both pronotum and propleuron densely cinereo-pubescent (the head sparsely so before the eyes), appearing coarsely dotted with large round black sub-shining spots where granules and tubercles occur, the anterior lobe of the pronotum with about nine irregular small black glabrous areas arranged in two more or less transverse series. Posterior lobe of pronotum very coarsely reticulated, each areole thus formed provided with a group of cinereous scale-like hairs on its floor. Corium sparsely provided with similar cinereous hairs.

Head a little shorter than the pronotum (233:253), much more than twice as long as wide across the eyes (233:103), the part before the transverse sulcus much shorter than the part behind it (90:143), the interocular space about three times as wide as an eye. First antennal segment a little longer than the head (250:233), the other segments missing. Cephalic spines very short, the three pairs about equally long, subequal in length to the thickness of the antenniferous tubercle as seen from the side.

Pronotum a little longer than wide (275:253), the humeral angles acute but hardly prominent, not elevated; posterior lobe with its middle portion strongly elevated, lightly longitudinally depressed along the median line, the elevated portion almost vertically declivous at each side; anterior lobe with numerous low conical tubercles whose height is not greater than their basal diameter. Fore femora with a setigerous tubercle in place of a spine on the dorsal side before the apex; posteroventral (outer) spines of the front femur short, distinctly shorter than the thickness of the rostrum; tibial spines normal for the genus. Hind margin of pronotum unarmed before the scutellum, but with a pair of divergent spinules at the posterior angles and with a few spines on the postero-lateral margins.

Abdomen (male) subparallel, the connexivum vertically reflexed in the type specimen, its lateral margin entire. Eighth abdominal segment almost continuously narrowed from the base, very feebly angulate-rounded at about the middle, the apex broadly rounded and with a very faint emargination at the center, very slightly surpassing the tips of the hemelytra. Male hypopygium not granulose on its ventral surface; terminal spine broadly triangular, its sides lightly sinuate; parameres slender, lightly clavate, oblique at the base, curved backward at about the middle so that the apical portions are subparallel and rather closely approximated to one another, with a few short hairs arising from the extreme tips.

Holotype, male, Huajuapán, Oaxaca, MEXICO, elevation 1600 meters, Sept. 12, 1948 (H. O. Wagner).

This species can be recognized at once by the conspicuous black spots where granules and tubercles occur among the cinereous pubescence of head, neck, and anterior pronotal lobe, and by the small groups of prostrate cinereous hairs in each of the areoles on the posterior lobe of the pronotum. Some other species of *Sinea* have similar, but smaller and browner, spots on the granulose meso- and metapleura, and numerous individuals of *Sinea confusa* have similar pubescence on a dark background on the corium, but none of these other species exhibit the characters of head and prothorax that are found here, nor do they have the preapical dorsal spine of the front femur reduced to an almost obsolete tubercle. The curved parameres of *S. sericea* are unique among the species of *Sinea* whose males I have examined, as in all the others known to me these appendages are straight or nearly so and approach one another at a decidedly obtuse angle.

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A NEW SPECIES OF PLESIOMMATA FROM MEXICO (Homoptera-Cicadellidae)[1]

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Plesiommata alcorni n. sp.

Resembling *Plesiommata mollicula* (Fowler) but slightly smaller, outside dorsal brown spot of pronotum barely covering lateral margin not lengthened up back of eye, area of elytra between branches of R brown forming a broad band almost full length of elytra, and bulbous aedeagus with a broad apex instead of pointed as in *P. mollicula*. Length : 4.8 mm., ♀ 5 mm.

Color: General ground color milky white. Dorsum of head with frontal arcs showing anteriorly on each side as very light brown, apical spot black, median longitudinal black dash as in *mollicula* wanting, thorax with a pair of median broad diverging, longitudinal, brown stripes ending on scutellum and a small brown spot on margin of each side usually not touching head; elytra with black line on mesal margin to tip of clavus; all longitudinal veins to crossveins fairly broadly embrowned; R. from first branch near basal fourth to crossveins entirely embrowned; costal margin narrowly embrowned to apical fourth.

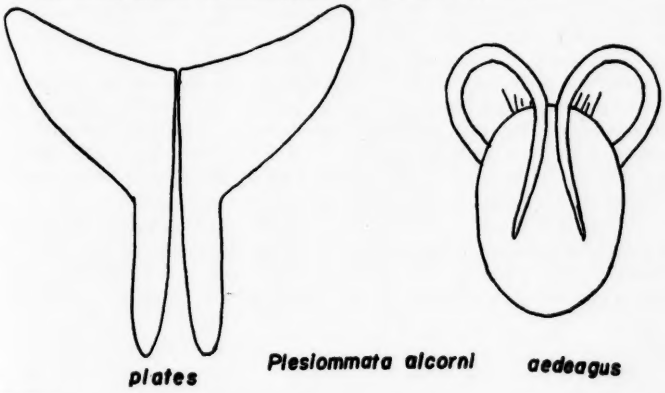
Genitalia: Male plates normal on basal two-thirds, apical third very long and slender. Side almost parallel, not more than one-fifth as wide as basal width of plate.

Internal male genitalia: Aedeagus an egg-shaped sphere somewhat flattened either side of apex; a pair of long slender processes arising at base curving out and around to end over opening in aedeagus.

Types: Holotype ♂, allotype ♀, 15 ♂ and 44 ♀ paratypes Compostela Nazarit, Mexico, November 1950, J. R. Alcorn.

Types in the Snow Entomological Collection.

I take pleasure in naming this species after Mr. J. R. Alcorn who has collected many species of leafhoppers for the Snow Collection.



[1]Contribution Number 801 from the Department of Entomology, University of Kansas.

THE RANGE OF VARIATION AND A NEW SYNONYM IN THE GENUS *MYELAPHUS* BIGOT (Diptera, Asilidae)

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The rare genus *Myelaphus* is one of the Dasypoginae which has distinctly five-segmented antennae. The elongate, lateral processes at the apices of the third and fourth antennal segments (See figures) separate the western *Myelaphus* from the eastern and southern, related *Ceraturgus* with cylindrical antennal segments. No other genus of Asilidae from the western United States possesses these tooth-like antennal structures which Bigot describes as "longe dentato". For this reason the identification of the genus seems certain in spite of other apparently inaccurate descriptions of the antennae by Bigot. His short description of *Myelaphus* is based on a single male specimen. On the basis of three specimens, Williston (1883) wrote a more complete generic description. In later notes Williston (1886) mentioned that there was much variation in *Myelaphus lobicornis* (O.S.) which he believed could be either within the species or between species. He did not name any additional species. Back saw several specimens of *Myelaphus rufus* Williston and "many specimens of *M. lobicornis*". He remarks: "When more collecting has been done, I believe that interesting facts of variation will be discovered."

The variability of the length of the three distal segments of the antennae, the variable wing venation, and the wide range in the black and red color pattern variation of a series of 25 specimens of *Myelaphus rufus* and several of *lobicornis* prove Back's words prophetic. Twenty of these specimens were sent by Mr. A. T. McClay of the University of California at Davis for identification. Dr. R. H. Beamer, University of Kansas, loaned the type of *M. rufus*. Mr. J. Wilcox, San Gabriel, California, loaned specimens. Dr. H. Bequaert, Museum Comparative Zoology, gave in trade a specimen of *M. lobicornis* which is probably of the original type series; it has the proper locality label, Snake River, Id., Loew Coll., although no type label is on the pin. I am labeling it a topotype.

Antennal variation.—Bigot's description of the antennae of *Myelaphus melas* being as long as head and thorax and six-segmented is doubtless erroneous. Both Williston and Back comment on these descrepancies. All specimens which have been seen by the writer agree with Back's observation that the antennae are not quite as long as the dorsum of the thorax. None of the specimens have true, six-segmented antennae.

No previous mention has been made of the pseudo-segment at the base of the third antennal segment which is about one-third the length of the second segment (See figures). This apparent segment is formed by a deep constriction which sometimes continues three-fourths around the third segment.

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[1] Assisted by Grant-in-aid funds.

Of the thousands of Asilidae examined by the writer, probably not more than a half dozen specimens have had antennae abnormal to a major degree; in each case only one antennal segment was aberrant, usually in shape. In this short series of *Myelaphus* there are seven specimens which have antennae with abnormally shortened and sometimes misshapen segments. Two specimens have one normal antenna and the other shortened. On the short antenna of one specimen the third segment is slightly shorter than normal, while the fourth is considerably shortened (figs. 1&2). The second specimen has a shortened and sharply truncate fifth segment on the short antenna. On three other specimens of *rufus* and one of *lobicornis* both antennae are shorter than normal but of equal length. In each case the fourth segment of both antennae is shortened (figs. 2, 3 & 4). On a seventh specimen both antennae are of equal length but the fifth segment is short on one antenna while the fourth is shortened on the opposite.

Tubercle.—The moderately large obtuse tubercle below the antennae is present on all specimens of *Myelaphus rufus* and *melas* including the type of *rufus*. Williston does not specifically describe this tubercle for *rufus* but implies its existence by stating that *rufus* and *melas* agree closely in structure. He illustrated the tubercle for *melas* in 1883 (Ibid) and again in his Manual of North American Diptera (1908). Back uses the tubercle to separate *melas* and *rufus* from *lobicornis*.

Wing venation.—The variations in the wing venation of *Myelaphus* are generic rather than specific. Back observes that the fourth posterior cell of the wing (Comstock 3rd median cell) is open, closed, or petiolate in *lobicornis* which is also true for *rufus*. Williston (1886) noted a male of *rufus* with the fourth posterior cell closed in the margin while the female type

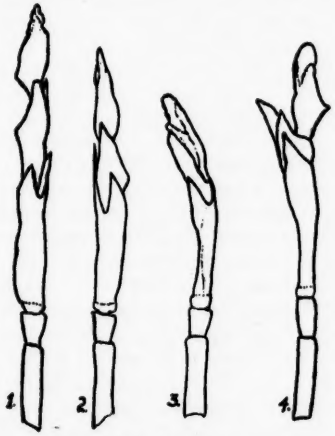

Plate I. Variations in the antennae of *Myelaphus rufus*.
Fig. 1 and 2. Antennae on same specimen; fig. 1 normal antenna.
Fig. 3 and 4. Additional variations in length of fourth segment and in shape of fifth segment.

specimen has an open fourth posterior cell. Some *rufus* specimens possess a short to long stump vein (R_3 of Shannon & Bromley) on the third longitudinal vein (R_3+R_4 of Shannon & Bromley). In all our specimens the anal cell is closed.

Color variation and synonomy.—The specimens at hand establish that *M. rufus* Williston is only a red and black variation of Bigot's totally blue-black *M. melas*. In the series of the writer are four totally blue-black *melas* which represent one extreme in color variation. In the other extreme are specimens totally red except for the three black distal segments of the antennae and some narrow black markings along the sutures of the pleura, and the tip of the proboscis is black. The thoracic disc of one of the red specimens is margined in black. In between the two extremes are specimens with minor and major variations.

Among the major variations are two specimens with the head, thorax, and first abdominal segment totally black; the remainder of the abdomen is red. The legs of one specimen are black, while those of the other are red. Among the nine specimens with three black stripes on the thorax there is only one which agreed closely with the type of *M. rufus* in its pattern of black markings on the head and thorax; it has a closed posterior fourth cell rather than an open cell.

In addition to the variations in the black patterns is a variation in the shade of the red color. A specimen sent by Dr. R. H. Beamer for identification is a dark, plum color which is intermediate between the usual orange-red and the blue-black. Probably Williston saw the specimen because it is labeled Kern Co. Calif., in the same hand writing as the type's label.

Williston observed that the male of *M. melas* and his type female of *M. rufus* agreed closely in structure. No stable morpohological differences have been found between the two species in the series at hand. Williston's well described and easily recognized species of *M. rufus* is a synonym of the meagerly described but recognizable *M. melas* Bigot. Because of the specimens with both the major color and morphological variations being collected at the same time of year and in the same locality or in localities very close to one another, there seems to be no justification for continuing the name *rufus* even as a subspecies name. The retention of this name would lead to an endless number of more names to be proposed for each variation. *Myelaphus melas* Bigot and *lobicornis* (O.S.) are the only two species in the genus at present. The latter was described earlier than *melas* in the genus *Ceraturgus* by Osten Sacken in Western Diptera, 1877.

M. melas collecting records.—California. Yolo County, six specimens Broderick, May 25, 1951 and eight specimens Elkhorn Ferry, May 17-25, 1951; single specimens, Putah Cyn., May 11, 1949; Davis, May 3, 1949; San Benito, May 25, 1936. Collectors: A. T. and M. F. McClay, D. C. Hall. H. E. Cott, R. N. Bohart, E. I. Schlinger, and E. S. Ross.

M. lobicornis collecting records—A specimen collected in N. Yakima, Washington, is in the Washington State College Collection. Wilcox has specimens from Riverside, California. These two records represent the most northern and southern limits of the species range as known at present.

Habitat: Mr. A. T. McClay and Mr. J. Wilcox report that they have col-

lected specimens of *Myelaphus* on the banks of streams. McClay collected some of his specimens on top of a dike along the Sacramento River.

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A NOTE ON A PHORID PARASITE OF *PHEIDOLE DENTATA* MAYR.[1]

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The parasitization of *Pheidole dentata* Mayr by Phorid flies was observed at Rockport, Texas, at 8:00 a.m. on April 18, 1952. The Pheidole colony was situated in very sand soil and had been disturbed the night before by the leg of a camp stool. In the morning the colony was moving to a new location approximately seven feet from the original nest. Minor workers were carrying larvae, pupae and males to the new site. A few major workers were observed dragging males, but most of the majors were merely running along with the rest of the ants.

Dr. C. D. Michener first observed the small flies hovering over the column of ants. On closer examination the author observed one of these flies dive down to a Pheidole pupa which was being carried by a minor worker. After a brief tussle of only a few seconds, the fly flew up and came to rest on a blade of grass about an inch above the moving column of ants. The ant carrying the pupa which had been attacked moved on immediately. Two other flies were observed landing on Pheidole pupa in the same manner. Five of these flies were collected together with the ants.

Dr. Willis W. Wirth of the U.S. National Museum kindly identified the flies as probably being the undescribed females of *Apocephalus aridus* Malloch. Members of the genus Apocephalus have been observed attacking adult workers of the genus Camponotus (1) (2) and Solenopsis (4). Flies belonging to related genera have also been observed attacking the heads of adult workers (3) (4) (5).

The observations described in this paper are interesting in that they indicate another possiblity in the method of attack of at least one species of Phorid. It is unfortunate that the pupae and workers which were attacked were not individually collected so that the site of attack, whether in pupa or worker, could be definitely determined. However, the small size of the minor workers in comparison with the size of the flies strongly suggests that the flies were attacking major worker pupae with their large heads rather than the minor workers carrying the pupae.

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[1] Contribution No. 819, Department of Entomology, University of Kansas.

A NOTE ON THE BIONOMICS OF THE GREEN STINK BUG (Hemiptera: Pentatomidae)

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The green stink bug, *Acrosternum hilare* (Say), has been the subject of several extended investigations. It has been studied in Ohio by Whitmarsh (1914, 1917), in Virginia by Schoene and Underhill (1933) and Underhill (1934), in Utah by Sorenson and Anthon (1936), and in Illinois by Esselbaugh (1949).

The green stink bug is an insect which feeds on the developing seeds and fruits of a wide variety of plants and has attracted considerable attention because of the damage it often does to Lima beans and to orchard fruits. The various authors noted above are in general agreement concerning the gross features of life history and biology; however, there are some differences in the reported time and duration of oviposition and in the average length of time required for the development of the last four instars. Whitmarsh and Esselbaugh agree that oviposition begins in early June and is completed by the end of July, whereas Underhill and Sorenson and Anthon observed that oviposition began one or two weeks later and extended to September.

The differences in time required for nymphal development are considerable. Since the various authors reared their specimens under different conditions, the variations in development may reflect only differences of food and temperature. On the other hand, it is possible that a genetic factor is involved and that radical differences exist between the different localities.

It was Underhill's experience in Virginia, based on several hundred individuals reared during four consecutive seasons, that 46 days was the average time required from date of egg deposition to adult. This is almost one-third less than the 72-day average reported by Sorenson and Anthon. However, it should be noted that Sorenson and Anthon's results were based on only 17 specimens. Whitmarsh, working in Ohio, reported maximum and minimum duration of instars based on an unspecified number of individuals. Unfortunately, these figures cannot be used to determine an average for complete development. For one egg mass he did record a minimum of 57 and a maximum of 83 days from egg deposition to adult. The average of these extremes is only 2 days less than that found by Sorenson and Anthon. Esselbaugh's reported average of 58.7 is almost exactly intermediate between that found by Underhill and that found by Sorenson and Anthon.

My observations concerning the green stink bug began in August 1950 when I collected one fourth instar in Illinois. In September a fifth instar was taken in Maryland and both emerged as adults near the last of September. Fortunately, they were of opposite sex, and they were kept alive for further study. Throughout the observation period they were fed on a diet of green string beans and kept in a room having thermostatically controlled temperature which never fell below 68° F.

The pair was observed to mate the first time on February 3, 1951. Three days later the female laid a mass of 26 eggs. Twenty-five of the eggs hatched 9 days later. The first adults emerged March 26 and the last emerged April 27. Average time required for development was 55.2 days, with a minimum of 49 and a maximum of 81. Of the 24 adults produced, 14 were male and 10 were female. On an average, males emerged about 2 days earlier than females.

The range in time required for development of the various individuals is remarkable, since all came from the same egg mass and were reared under identical conditions. Whitmarsh had somewhat similar results which were more significant since his observations were based on a very much larger number of individuals of various parentage. Even so, his difference of 25 days is noticeably less than the 32 which I observed and raises the possibility that the variation occurring among my specimens reflects a hybridizing effect resulting from the mating of an Illinois male with a Maryland female. This would presume that the Maryland female belonged to a strain similar to that studied by Underhill, while the Illinois male represented that studied by Whitmarsh. Such a possibility suggests an interesting subject for further study.

Twenty-three additional eggs were laid by the female in four masses; however, all were destroyed by the male within a few hours after they were deposited. The female died March 15 and was survived by the male until May 15.

The first mating among the F_1 generation was observed May 2, 1951, or 89 days after the first mating of the original pair. Eggs were deposited May 6, or 93 days after deposition of the eggs which produced the F_1 specimens. This does not provide an indication of when the 10 F_1 females would have laid the maximum number of eggs, but it does demonstrate that a cycle can be completed in about 3 months, and that in this instance there was no evidence of an obligatory diapause.

Previous workers have believed the green stink bug to be a one-generation species. This may be true over most of its range; however, there is no obvious reason why at least two generations are not possible under favorable conditions such as might be encountered in the Gulf States.

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THE ISOLATION OF BACTERIUM TULARENSE FROM THE TICK, AMBLYOMMA AMERICANUM

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During the summer of 1950, while one of us (C. E. H.) was employed by the Communicable Disease Center, U.S.P.H.S., a series of spot-backed ticks, or *Amblyomma americanum* (Linnaeus, 1758) was collected in the Hatfield environs, Polk County, Arkansas. The ticks were obtained during the weekend of July 1, from vegetation, by flagging method along an old logging road in a secondary timber stand of mixed oaks and evergreens. These ticks were collected for the purpose of restocking laboratory colonies of this species, in order to continue further studies on tick transmission of tularemia upon returning to the University of Kansas the following September.

The isolation of *Bacterium tularense* was accomplished by following the routine procedure of injecting part of a tick pool into guinea pigs for the possible recovery of organisms pathogenic to man, before attempting to use freshly caught ticks in laboratory work. On this occasion, 14 adult ticks were ground in sterile saline and 1 ml. of the suspension injected intraperitoneally into each of two guinea pigs. Within 72 hours after receiving the inoculation, both guinea pigs were dead. At autopsy, the gross pathology was characteristic of tularemia. Plate cultures made of the spleen and heart blood appeared to substantiate the observations of the gross pathology. As an additional check, mice were injected with a standardized suspension of organisms prepared from the plate cultures. These animals died in the expected length of time, and cultures of organisms like those isolated from the guinea pigs were recovered from tissue and heart blood. A Gram's stain and agglutination with anti-tularemia serum were used as additional aids in the identification of the organisms. The results of these procedures confirmed the isolated organism as *Bact. tularense*.

As further confirmation of the primary isolation, the remainder of the ticks (consisting of 20 specimens) for this particular pool was ground and injected as above and identical procedures were carried out after the death of the guinea pigs. The results of the second attempt confirmed those of the primary isolation. Therefore, it was considered that ticks belonging to the species *A. americanum* had been found naturally infected with *Bact. tularense*.

LD_{50} titrations were undertaken to establish data concerning the virulence of these tularemia organisms which are thenceforth designated as the "Aa" strain of *Bact. tularense*. The titrations were undertaken following one transfer of the organisms from the original plate cultures. Guinea pigs, mice and rabbits were utilized as the experimental animals for this work. The LD_{50} was calculated according to the method of Reed and Muench (1938). The organism Aa was suspended in saline to give a standard turbidity in the Coleman spectrophotometer. This standard suspension contains 2 to 4 billion organisms. Ten-fold dilutions are made, plated, and injected into the test animals. A dilution of 10^{-9} therefore contains 2 to 4 organisms per ml. Table

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1 gives the results of the titrations and compares the Aa strain with a fully virulent one, designated as Sm.

As the results in Table 1 indicate, the new strain (Aa) appears to be highly virulent and apparently has an LD_{50} similar to that of the Sm. strain.

Table 1—The LD_{50} of the Aa strain of *Bacterium tularense* as compared to the fully virulent Sm strain

Strain of *Bact. tularense*	Guinea Pig LD_{50}	Mouse LD_{50}	Rabbit LD_{50}
Aa	$10^{-9.4}$	$10^{-8.9}$	$10^{-9.5}$
Sm	$10^{-9.5}$	$10^{-9.5}$	$10^{-9.5}$

This initial isolation of *Bact tularense* from *A. americanum* is thought to be of more than casual importance. From the results of field studies carried out in Arkansas and surrounding areas during 1947, 1948, and 1949, Hopla (1953) indicated that this tick would be the most likely vector concerned in the tick transmission of tularemia organisms to man in this area. Washburn and Tuohy (1949) reported a high incidence of human cases of tularemia in Arkansas and further indicated that slightly over 50 per cent of these cases were tick borne. On the other hand, it is not desired to claim that the tick-tularemia problem for this area has been solved, but it is thought that a good foundation has been established, and that further studies must be undertaken before the tick transmission of tularemia is clearly understood in this area.

SUMMARY

1. Spot-backed ticks *(Amblyomma americanum)* collected in Arkansas were found naturally infected with *Bact. tularense* in 1950. This is the first reported observation of this species being infected with *Bact. tularense* in nature.

2. The organisms isolated from these ticks appear to be fully virulent. This tick strain of *Bact. tularense* has been designated as "Aa" and is maintained in the laboratory at the University of Kansas, Lawrence.

ACKNOWLEDGEMENTS

Appreciation is expressed to Mr. John E. Taylor, Director, CDC Activities, Arkansas, who has supported the authors in many ways.

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A NEW SUBGENUS AND SPECIES OF ENITHARES

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Two South American specimens of Enithares (Notonectidae, Hemiptera) were sent to me for determination by Dr. H. B. Hungerford of the University of Kansas. An examination of the male genital capsule revealed it to be asymmetrical. This condition is known to be true of only one other species of this genus, *Enithares braziliensis* Spinola which is found also in South America. However, observations of the females of the two above mentioned forms revealed no characters distinct enough to set them apart from other females of this genus. Hence, I'm erecting a subgenus for those species of Enithares whose males possess asymmetrical genital capsules.

Enitharoides new subgenus

General facies is typical of the genus Enithares. As seen from above the body is conical in shape, being broadest along the posterior margin of the pronotum. Dorsally each eye occupies about one third of the surface with their inner margins converging slightly toward the pronotum. Pronotum trapezoidal in shape, broadest at posterior margin; antero-lateral pronotal angles foveate. Scutellum with basal width greater than median length. Hemelytra opaque and fit snugly over the body. Each hemelytron bears a cleft directed inward from the lateral margins and immediately anterior to the membranal suture. This is called the nodal furrow. Labrum triangular in shape. Infracoxal plates bare but margined with hair. Right and left claspers of male genital capsule unlike. Posterior margin of genital capsule cleft.

Subgenotype: *Enithares Enitharoides duidaensis* in United States National Museum.

Enithares Enitharoides duidaensis

Size: Length 13.0 to 14.0 mm., greatest body width, 5.2 to 5.6 mm.
Color: Eyes Brown; vertex and pronotum testaceous the latter may be irregularly colored brown along anterior half, posterior margin may be hyaline and appear black, due to underlying black portion of scutellum; scutellum dark brown or black with margins irregularly colored testaceous; hemelytra with clavus and corium testaceous, also possessing irregular hyaline areas which allow the black color of the dorsal abdominal surface to be seen; membrane dark brown; legs and abdominal venter dark brown.
Structural Characteristics: When viewed from above the head is almost nine tenths as wide as the pronotal humeral width; anterior outline rounded; vertex with its anterior width almost one third the greatest width of the head and slighly more than its median length; synthlipsis wide, slightly less than anterior width of vertex; along the median longitudinal axis the head is almost two thirds as long as the pronotum. Pronotum with its humeral width three times the median length; pronotal fovea with dorsal margins diverging. Labrum with its median length almost equal to its basal width; apex acuminate, metaxyphus with lateral margins convex and converging slightly, bending medianly to meet in an acuminated apex. Male genital capsule as shown

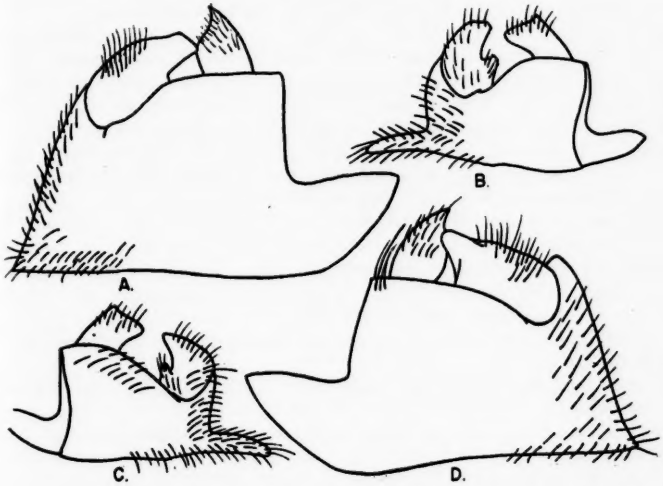
in text figures 1, B and C. The relative lengths of the parts of the legs are as follows:

	Femur	Tibia	1st. Tar. Seg.	2nd. Tar. Seg.
Front leg	100	110	35	20
Middle leg	100	84	34	20
Hind leg	100	83	45	20

Location of Type: Male holotype and female allotype (Venezuela, Exp., Territ. Amazonas. Top Mt. Duida, June 2-3, 1950) in United States National Museum.

Comparative Notes: This species is very similar in general appearance to *Enithares braziliensis* Spinola. However the male genital capsule of *E. braziliensis* lacks the posterior extension as borne on the male genital capsule of *E. duidaensis*. The claspers of the two species are also shaped differently. See text figure.

Data on Distribution: Known only from type series.



Text figure Guide for "A New Subgenus and Species of Enithares"

Male genital capsules of *Enithares Enitharoides braziliensis* Spinola and *Enithares Enitharoides duidaensis* n. sp.

A. Right view of genital capsule of *E. Enitharoides braziliensis.*
B. Left view of genital capsule *E. Enitharoides duidaensis.*
C. Right view of genital capsule of *E. Enitharoides duidaensis.*
D. Left view of genital capsule of *E. Enitharoides braziliensis.*

CONCERNING MESOVELIA DOUGLASENSIS HUNGERFORD[1]

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In the summer of 1923, I collected about forty apterous specimens of this little species from Bryant's Bog, Cheyboygan County, Michigan and in 1924 described it as new. In 1928 at the British Museum, I found in the type series of *Mesovelia amoena* Uhler some apteous female specimens that I thought must be the same as my *M. douglasensis*.

Uhler described only the winged form from the Island of Grenada and did not mention the apterous specimens that were collected with it. The color of the two forms is decidedly different. In 1930, Jaczewski also noticed the similarity of the wingless *M. amoena* Uhler and *M. douglasensis* Hungerford but could not decide the matter because he had no males of *M. amoena* Uhler for dissection.

Every summer since 1923 I have sought winged specimens of *M. douglasensis* Hungerford from Bryant's Bog and not until 1951 were any such specimens taken. In 1951, Dr. Wayne Porter caught two winged females in Nichol's Bog but both specimens had broken off the hemelytral membranes. On July 12, 1952, Irwin Slesnick, one of my students, brought me a winged male from Bryant's Bog and this renewed an intensive search at that place for more winged specimens with the result that on July 23 two winged females were captured and none thereafter. During the summer, Irwin Slesnick, Paul Spangler and I collected more than one hundred wingless specimens of this species in Bryant's Bog and could have taken many more.

I now have compared the winged *M. douglasensis* from the type locality with winged specimens from Florida and am convinced they are the same species. Moreover, all those shown in the chart opposite, where males are available, have the claspers like the type series from Michigan.

Since both the winged and apterous females resemble *M. amonea* Uhler, it is desirable to secure and examine males from Grenada or nearby islands to settle the question.

There is a South American species that superfically looks somewhat like *M. douglasensis* but is structurally different.

Unfortunately, all I can say at present, is that the distribution of *M. douglasensis* extends from Michigan to Florida and that winged forms are more common in the South.

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[1]Contribution from University of Michigan Biological Station and No. 832 from the Department of Entomology, University of Kansas.

Locality	Date	Collector	Number of Apterous ♂	Apterous ♀	Winged ♂	Winged ♀
Homestead Florida	8- 9-1930	R. H. Beamer		1		
Ft. Myers, Florida	8-14-1930	J. Nottingham		1		
Childs, Florida	8- 6-1930	R. H. Beamer		1		
Fruitville, Florida	8-14-1930	Paul Oman		2		
Lake Placid, Florida	7-16-1948	L. D. Beamer			1	
Lake Placid Florida	12-21-1949	H. B. Hungerford		1		1
Ft. Mead, Florida	8-13-1930	R. H. Beamer		1		
Lake Jovita, Florida	7-20-1934	P. McKinstry	2	8		
Sanford, Florida	8- 4-1930	Paul Oman				1
Orlando, Florida	1-10-1938	H. B. Hungerford		1		
Plant City, Florida	8-15-1930	Paul Oman		4		
Orange Co, Florida	1-10-1938	H. B. Hungerford		1		
Palatka, Florida	3-10-1947	R. H. Beamer		2		
Sanford, Florida	3-11-1947	L. D. Beamer		1		
Branford, Florida	7-16-1934	P. McKinstry		1		
Hilliard, Florida	8-31-1930	Paul Oman	2	6	6	21
Okefenokee Sw., Georgia	7-27-1939	R. H. Beamer	7	11		1
Okefenokee Sw., Georgia	7-25-1939	L. D. Beamer		5		
Okefenokee Sw., Georgia	8- 3-1934	R. H. Beamer	4	11	1	1
Folkson, Georgia	8- 2-1934	R. H. Beamer	1	1		
Grand Bay, Alabama	7-11-1934	P. McKinstry	1	7		
Batesburg, S. Carolina	8-24-1930	Paul Oman		2	1	
Dismal Sw., Virginia	8-13-1934	McKinstry & Beamer	1	1		
Woodbridge, Virginia	8-28-1946	L. D. Beamer	26	27		

THE MEMBRACID GENUS MULTAREIS, AND A NEW GENUS, MULTAREOIDES (Homoptera)*

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Three genera of Membracidae are known to occur on *Larrea tridentata* Cav. In an earlier paper (Cook, 1952) the author reviewed the genus *Centrodontus* Goding. This paper presents a review of the other two, *Multareis* Goding and *Multareoides* n. gen. All three genera are restricted to North America, and by far the greater number of specimens are from localities in the southwestern United States. Only meager material is available from Mexico, but future collecting will undoubtedly show that the genera are well represented there also.

The host plant, also known by the common names greasewood and creosote bush, is widely distributed over North American desert areas and is the only species of *Larrea* that occurs there. Dr. Ivan M. Johnston of the Arnold Arboretum, Harvard University, has told the author (in litt.) that the plant "occurs in practically indistinguishable form over large areas in the western parts of Argentina." It will be interesting, when material is available, to establish whether or not representatives of these genera are also found on the plant in Argentina. A map showing the distrbiution of the host plant has been published previously (Cook, 1952; fig. 32).

Genus Multareis Goding

Type *Multareis cornutus* Goding (original designation)

1895 *Multareis* Goding, Canad. Ent. 27:274.
1903 *Multareis*, Buckton, A Monograph of the Membracidae, p. 268.
1908 *Multareis*, Van Duzee, Bull. Buffalo Soc. Nat. Sci., 9:114.
1916 *Multareis*, Van Duzee, Check List of the Hemiptera of America North of Mexico, p. 62.
1917 *Multareis*, Van Duzee, Catalogue of the Hemiptera of America North of Mexico, p. 563.
1927 *Multareis*, Funkhouser, General Catalogue of the Hemiptera, Fascicle 1, Membracidae, p. 55.
1951 *Multareis*, Funkhouser, Genera Insectorum, Fascicle 208, Family Membracidae, p. 57.

Resembling *Centrodontus*, but having preocular tubercles, venation more reticulate, and more deeply punctate.

Dorsal Aspect: Greatest width of head excluding eyes 12 to 40 times median length; cephalic margin of head bisinuate (largely because of preocular tubercles), this margin not parallel with cephalic margin of pronotum; pronotum anteriorly almost as wide as head at outer margins of eyes, abruptly expanded at humeri to approximately same width or wider than head; posterior process of pronotum acuminate, apex sharply rounded; median carina usually distinct; coarsely and deeply punctate.

Lateral Aspect: Tegmina extending only slightly caudad of abdomen, extending caudad of posterior pronotal process by more than a third of

*Contribution No. 814 from the Department of Entomology, University of Kansas.

their length; venation reticulate, basal fourth punctate; pronotum forming a large gibbosity above humeri, a secondary protuberance on its caudal slope, sometimes with a cornute or tuberous structure on each side above humerus; a protuberance near middle of posterior process and another much smaller one at apex; a prominent tubercle on cephalic margin of head mesad of each eye.

Color: Largely brown to black.

Distribution: Arid regions of the southwestern United States, northern Mexico, and Baja California.

The genus Multareis formerly included the species *cornutus* Goding, *planifrons* Van Duzee and *digitatus* Van Duzee. The author believes *planifrons* and *digitatus* are generically distinct from *cornutus,* and is placing them in a new genus, *Multareoides,* which follows. Thus the genus contains only one species, *cornutus.*

This genus is very close to *Centrodontus,* and it is very possible that with future investigations it will prove to be synonymous with or a subgenus of *Centrodontus.* With the taxonomy of the Membracidae in its present state it does not seem advisable to make the aforementioned revision. There are other genera in the Membracidae at present considered distinct which are less different than are *Multareis* and *Centrodontus.*

Multareis cornutus Goding

Resembling *Centrodontus atlas,* but venation more reticulate, more coarsely and deeply punctate, and having preocular tubercles; females may have a dorsal cornute process on each side of pronotum above humerus. Length: Females 3.5 to 4 mm.; males 2.7 to 3.5 mm.

Anterior pronotal gibbosity bearing cornute or tuberous processes in some females; coarsely and deeply punctate; numerous wax-covered hairs on pronotum caudad of eyes and ventrally; ocelli prominent, closer to eyes than to each other; anteantennal ridge sinuate; a tubercle caudad of eye, usually connected with humerus by a very small carina; tegmen sometimes partially subhyaline, usually opaque.

Color: Tibiae usually with two dark and three straw colored areas; ventrally dark to black.

Male Genitalia: In ventral view subgenital plate broadest near base, the two halves not fused (apparent only if boiled in caustic or otherwise softened); narrowing from base to near middle, then approximately parallel-sided to near rounded apex; in lateral view ventral margin of subgenital plate more or less smoothly rounded from middle to apex, basal third at angle to medial third (dissected); gonoforceps extending cephalad of base of subgenital plate, widest at middle, narrowing caudally, abruptly widened at avicephaliform apex; in ventral view posterior arm of aedeagus four and one-half to six times as long as medial width; in lateral view posterior arm four to four and one-half times as long as medial width; tooth on lateral valve bluntly rounded, approximately as long as basal width.

Host: Larrea tridentata Cav.

This is the only known species of the genus and is widespread in the Southwest. It is here divided into two subspecies, a discussion of which is given in the section entitled "Geographical Variation". The synonymy is indicated under the subspecies.

Approximately 525 specimens of the species were examined in this study.

Key to Subspecies of Multareis cornutus

1a. Pronotum with a dorsal cornute process on each side above humerus, varying in size but always present ..... *cornutus cornutus* ♀.
1b. Pronotum lacking dorsal cornute processes ..... 2.
2a. In dorsal view preocular tubercle extending forward approximately one-third length of eye; ocelli prominent ..... *cornutus cornutus* ♂.
2b. In dorsal view preocular tubercle extending forward, but less than one-third length of eye; ocelli less prominent ..... *cornutus lawsoni*.

Multareis cornutus cornutus Goding
Figs. 1 to 6; 20-26

1895 *Multareis cornutus* Goding, Canad. Ent., 27:274.
1903 *Multareis cornutus*, Buckton, A Monograph of the Membracidae, p. 268.
1908 *Multareis cornutus*, Van Duzee, Bull. Buffalo Soc. Nat. Sci., 9:114.
1916 *Multareis cornutus*, Van Duzee, Check List of the Hemiptera of America North of Mexico, p. 62.
1917 *Multareis cornutus*, Van Duzee, Catalogue of the Hemiptera of America North of Mexico, p. 563.
1927 *Multareis cornutus*, Funkhouser, General Catalogue of the Hemiptera, Fascicle 1, Membracidae, p. 56.
1951 *Multareis cornutus*, Funkhouser, Genera Insectorum, Fascicle 208, Family Membracidae, p. 58. (Plate 1, figure 11 not this species.)

Brown with dark markings, females with a cornute or tuberous process on pronotum above each humerus. Length. Females 3.6 to 4.2 mm.; males 3 to 3.5 mm.

Head nearly 1.5 times wider than medial height including clypeus; ocelli very prominent; in dorsal aspect greatest width of head excluding eyes 10 to 40 times medial length; preocular tubercle very prominent, usually extending slightly in front of eye; female with a cornute or tuberous structure on pronotum above each humerus which is widely variable in size, males sometimes with incipient cornute structures; secondary protuberance of anterior pronotal gibbosity prominent; middle protuberance of posterior process well developed.

Color: Females generally brown with black markings, males black but often with brown markings on tegmen and occasionally brown marking on pronotum; tegmen with two white bands (veins dark), one posterior to basal punctate area, the other near apex; remainder of tegmen brown or black, rarely all white (veins usually dark) except at base and apex; head darker than pronotum in female, of same color in male; wax-covered setae forming white or straw-colored areas on pronotum caudad of eyes; ventrally dark to black with many wax-covered setae forming white or straw areas.

Male Genitalia: Recurved portion of avicephaliform apex of gonofor-

ceps less sharply pointed than in *M. c. lawsoni;* in ventral view posterior arm of aedeagus nearly six times as long as medial width, nearly parallel-sided, slightly widened at middle; in lateral view posterior arm four and one-fourth times as long as medial width; posterior arm smooth, not bearing minute spines or setae.

Distribution: Arid regions of the southwestern United States, northern Mexico, and Baja California. Peripheral localities: Las Vegas, Nevada; Panamint Valley, Little Lake, Daggett, Palm Springs, San Diego County (eastern), and El Centro, California; Yuma, Ajo Mountains, Santa Rita Mountains, Tucson, Vail, Safford, Miami, and Congress Junction, Arizona; St. George, Utah; Littlefield, Arizona. Also Kino Bay, Sonora, Mexico.

Lectotype (here designated) ♀, cotype ♀: Panamint Valley, California, April, 1891.

Neoallotype ♂: Palm Springs, California, March 10, 1935 (E. P. Van Duzee).

Parallotypes, all ♂ ♂: 1, Empire Mountains, Arizona, August 18, 1935 (E. D. Ball); 7, Phoenix, Arizona, March 13, 1930 (E. D. Ball); 1, Tucson, Arizona, August 16, 1935 (Jack Beamer); 1, Tucson, Arizona, April 7, 1929 (E. D. Ball); 2, Tucson, Arizona, April 20, 1930 (E. D. Ball); 1, Tucson, Arizona, April 1, 1934 (Owen Bryant); 1, Vail, Arizona, August 18, 1935 (Jean Russell); 1, Ajo Mountains, Arizona, April 22, 1935 (E. D. Ball); 1, Littlefield, Arizona, March 27, 1931 (E. W. Davis); 1, Palm Springs, California, March 10, 1935 (E. P. Van Duzee); 1, Baker, California, April 9, 1942 (Owen Bryant); 1, Joshua T. N., August 8, 1930; 1, Glendale, Nevada, April 15, 1932 (E. W. Davis); 2, Glendale, Nevada, May 5, 1929 (David E. Fox).

Lectotype, cotype, neoallotype, and 8 parallotypes in the United States National Museum; 1 parallotype in the University of Minnesota Collection; 1 parallotype in the collection of R. A. Flock; 2 parallotypes in the Snow Entomological Collections; 9 parallotypes in the author's collection.

Members of the genus *Multareoides,* which follows, have been often confused with this subspecies. The author has seen examples of *Multareoides bifurcatus* and *Multareoides digitatus* determined as *Multareis cornutus,* and Funkhouser's (1951; pl. 1, fig. 11) drawing labeled *Multareis cornutus* is a male of *Multareoides digitatus.* The description given above includes the male of *Multareis cornutus cornutus* which has been previously undescribed.

Multareis cornutus lawsoni n. subsp.

Figs. 7 to 19; 27 to 30

Resembling *Multareis cornutus cornutus* but slightly smaller, lacking the cornute processes of *cornutus* females, both sexes less deeply punctate, and with smaller preocular tubercles. Length: Female 3.5 to 3.8 mm.; male 2.7 to 3.2 mm.

Head nearly 1.5 times wider than medial height including clypeus; anteantennal ridges less sinuate than in *M. c. cornutus;* ocelli prominent; in dorsal aspect greatest width of head excluding eyes approximately 12 times medial length; preocular tubercle prominent, smaller than in *M. c. cornutus;* lacking cornute processes on pronotum above humeri; secondary

protuberance of anterior pronotal gibbosity and middle protuberance of posterior process well developed, less prominent than in *M. c. cornutus;* coarsely and deeply punctate, but less so than *M. c. cornutus;* wax covered setae posterior to eyes and ventrally.

Color: Females brown marked with black, males brown to black; tegmen with two white bands (veins usually dark), one posterior to basal punctate area, the other near apex, remainder of tegmen brown or black, rarely all white (veins usually dark) except at base and apex; head darker than pronotum.

Male Genitalia: Recurved portion of avicephaliform apex more sharply pointed than in *M. c. cornutus;* in ventral view posterior arm of aedeagus nearly four and one-half times as long as medial width, widened at middle; in lateral view posterior arm four to four and one-half times medial width; posterior arm bearing minute spines or setae dorsolaterally.

Distribution: Arid regions of the southwestern United States, northern Mexico, and Baja California.

Holotype ♀, allotype ♂: Hot Springs, New Mexico, July 22, 1950 (Paul P. Cook).

Paratypes: 1 ♀, Tucson, Arizona, April 9, 1908; 5 ♀ ♀, Douglas, Arizona, July 19, 1950 (Paul P. Cook); 1 ♀, Marathon, Texas, July 1-2, 1916; 2 ♂ ♂, Sanderson, Texas, May 9, 1912 (J. D. Mitchell); 2 ♀ ♀ and 2 ♂ ♂, El Paso, Texas, August 9, 1908 (F. C. Pratt); 3 ♂ ♂, Marfa, Texas, June 7, 1906 (Mitchell and Cushman); 1 ♂, New Mexico, 1901 (C. F. Baker); 2 ♀ ♀, Rodeo, New Mexico, June 8, 1933 (P. W. Oman); 15 ♂ ♂ and 18 ♀ ♀, Carlsbad, New Mexico, June 27, 1932 (R. H. Beamer); 9 ♂ ♂ and 28 ♀ ♀, Hot Springs, New Mexico, July 22, 1950 (Paul P. Cook).

Holotype, allotype, 40 ♀ ♀ and 21 ♂ ♂ paratypes in the Snow Entomological Collections, University of Kansas; 2 ♀ ♀ and 4 ♂ ♂ paratypes in the United States National Museum; 1 ♀ paratype in the California Academy of Sciences; 1 ♀ paratype in the American Museum of Natural History; 13 ♀ ♀ and 7 ♂ ♂ paratypes in the author's collection.

Localities not included in the list of types: Texas: Barstow, Big Bend Park, Culberson County, Fort Stockton, Laredo, Presidio County, Sheffield, 47 miles west of Sheffield; New Mexico: Blue Springs, Las Cruces, Roswell, Socorro County; Arizona: Hereford; Mexico: Satillo, Coahuila, and Monclova, Coahuila.

Geographical Variation

Multareis cornutus lawsoni, the eastern subspecies, is widely distributed in Texas and New Mexico. *M. c. cornutus* is the western subspecies, and occurs in Arizona, southwestern Utah, southern Nevada, and southern California. Available material indicates that the separation of the two in the United States nearly coincides with the break in the distribution of *Larrea,* which is roughly along the Continental Divide. Exceptions in this separation occur in southeastern Arizona and extreme southwestern New Mexico. There *M. c. lawsoni* is present west of the Continental Divide as shown by scanty material from Tucson (1 female), Douglas (5 females),

and Hereford (1 female), Arizona, and from Rodeo, New Mexico (3 males and 2 females). The only actual overlap of the subspecies (in the material at hand) is at Tucson, and there are no intermediate specimens. Thus the two forms seem to behave as species in this region.

In the Imperial Valley of southern California *M. c. cornutus* females undergo a great reduction of the pronotal cornute processes and a somewhat lesser reduction of the preocular tubercles, until a point is reached where specimens are intermediate between the two subspecies. There are other specimens of both sexes which resmble *M. c. lawsoni,* and still others which, though still more nearly resembling *M. c. lawsoni,* bear incipient cornute processes on the pronotum and enlarged preocular tubercles. This variation is also apparent in some specimens from southwestern Utah, where these intergrades seem to have followed the Colorado River canyon and thus somewhat parallel the phenomenon encountered with *Centrodontus atlas reticulatus.* Localities from which intermediate specimens are recorded include: El Centro, Ocatillo, 1,000 Palms, and Holtville, California; Leeds, and St. George, Utah; Beaver Dam, and Littlefield, Arizona; and Punta Prieta, Baja California.

The occurrence of *M. c. lawsoni* in the western area of *Larrea* distribution (southeastern Arizona and southwestern New Mexico) is difficult to understand. Equally perplexing is the fact that, though intermediate specimens occur in the low altitude area of southern California, the two subspecies apparently do not interbreed in the former area. A possible explanation is that intermediate populations occur in the more southern areas of *Larrea* distribution and may have followed the low altitude in northwestern Mexico into the Imperial Valley region of southern California. Unfortunately northern Mexico has been so poorly collected that specimens which might clarify the situation are not available.

Genus Multareoides n. gen.

Resembling *Multareis,* but with preocular tubercles greatly reduced, punctations of tegmina extending past basal fourth, posterior pronotal process or entire pronotum laterally compressed, and lacking the terminal protuberance of the posterior pronotal process. Length: Females 3.3 to 4.2 mm.; males 3.3 to 3.6 mm.

Dorsal Aspect: Greatest width of head excluding eyes at least 12 times visible median length, medial portion of head sometimes obscured by overhanging cephalic margin of pronotum; ocelli protruding only slightly; pronotum anteriorly same width or narrower than head at outer margins of eyes, abruptly expanded at humeri to wider than head; posterior pronotal process acuminate; median carina prominent; pronotum above humeri may show only slight indications of tuberous processes on either side, may bear a cornute or tuberous process, or may be high and bifurcate; densely punctate.

Lateal Aspect: Tegmina extending only a short distance caudad of abdomen, well caudad of apex of posterior pronotal process; venation reticulate, the cells subhyaline to opaque, punctations usually following veins into

apical half; pronotum highest anteriorly, often with a secondary protuberance on caudal slope; posterior process laterally compressed, a horizontally elongate protuberance near or caudad of middle which is much less abrupt than in *Multareis*.

Color: Nearly uniform straw; sometimes brown, often with darker areas on cephalic portions of pronotum, on head, and ventrally.

Male Genitalia: No dissection was made of *Multareoides planifrons* because only two male specimens are known to the author. *Multareoides digitatus* and *M. bifurcatus* were dissected, and both show genital structures which are variable within the same limits (figs. 43 to 50).

Type: Multareoides bifurcatus n. sp.

Distribution: Arid regions of the southwestern United States, northern Mexico, and Baja California.

This genus is erected to include *Multareis planifrons* Van Duzee, *Multareis digitatus* Van Duzee, and *Multareoides bifurcatus* n. sp.

Multareoides planifrons and *Multareoides bifurcatus* have been a source of considerable taxonomic confusion. The author has seen several specimens of both that have been determined as *Multareis cornutus,* and the figure labeled *Multareis cornutus* by Funkhouser (1951: pl. 1, fig. 11) is a male of *Multareoides digitatus*.

Approximately 400 specimens of the genus were examined in this study.

Key to Species of Multareoides

1a. Pronotum just cephalad of humeri high, nearly coming to a point at bifurcate summit, ratio of width of pronotum at humeri to height of pronotum in cephalic view approximately 1:1; posterior pronotal protuberance usually large and occupying approximately half of posterior process ..... *bifurcatus.*

1b. Pronotum not so high, may have a cornute process on each side, the processes high and widely separated or low, in the latter case ratio of width of pronotum at humeri to height of pronotum in cephalic view approximately 3:2; posterior pronotal protuberance smaller, occupying approximately a third of posterior process ..... 2.

2a. Female ..... 3.

2b. Male ..... 4.

3a. Cornute processes high, lateral portions extending vertically above humeri, apices widely separated (0.67 to 0.83 mm. apart)....*planifrons.*

3b. Dorsal processes lower, lateral portions slanting mesad, apices rather close together (0.5 mm. apart) ..... *digitatus.*

4a. Cells of tegmen relatively large, distal half with approximately 20 cells, punctations following some veins beyond basal third of tegmen *digitatus.*

4b. Cells of tegmen small, distal half with approximately 30 cells, punctations restricted to basal third of tegmen ..... *planifrons.*

(TO BE CONCLUDED)

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